United States Department of Agriculture	**Forest Service**	**Wallowa-Whitman National Forest**	**La Grande Ranger District** **3502 Highway 30** **La Grande, OR 97850**

Date: 9/14/2020

Subject: Sheep Creek Vegetation Management Project – Vegetation Existing Conditions/ Effects Analysis

To: Sheep Creek IDT

The purpose of this report is to describe the existing conditions in the Sheep Creek Vegetation Management Project area.
Information sources used to complete this report include:

- Historic Range of Variation (HRV) analysis

Proposed Project Location

The La Grande Ranger District, Wallowa-Whitman National Forest, manages the proposed project located at Township 5S and 6S, Range 35E, approximately 22 air miles southwest of La Grande, OR. The project boundary spans both the Chicken Creek and Sheep Creek Subwatersheds, which both drain into the Upper Grande Ronde River. This project is accessible by National Forest System Road (NFSR) 51 to the East and NFSR 5160 to the Northwest.

The project area, approximately 29,935 acres, is located entirely within Union County and divided by private land.

Management Direction

The 1990 Wallowa-Whitman National Forest Land and Resources Management Plan (Forest Plan), as amended by PACFISH/INFISH and Eastside Screens, forms the foundation for analysis of this project. The Sheep Creek project tiers to the Forest Plan for forest-wide management goals and objectives, standards and guidelines and special considerations listed under designated management areas. The following management areas are included in this project area:

MA1 – 17,828 acres. Emphasizes wood fiber production on suitable timberlands while providing relatively high levels of forage and recreational opportunities.

MA1W – 7,482 acres.

MA3 – 3,744 acres. Provides a broad array of Forest uses and outputs with emphasis on timber production. Timber management should be designed to provide near-optimum cover and forage conditions on big game winter ranges

MA 3A – 101 acres. Same as MA3.

MA 15 – 761 acres. These areas are designated to maintain habitat diversity, preserve aesthetic values, and to provide old-growth habitat for wildlife. Evidence of human activities may be present but does not significantly alter the other characteristics and would be a subordinate factor in a description of such a stand.

Background Information

Changes within the proposed project area over the last century have resulted in stand structures, conifer densities, down woody structure and understory plant communities that deviate from those described historically. These shifts in forest structure, species composition, and stand density have been caused by fire exclusion, livestock grazing and past timber harvest practices. This area was heavily managed for timber harvest during the 1970-1980s as seen in figures 1-3.

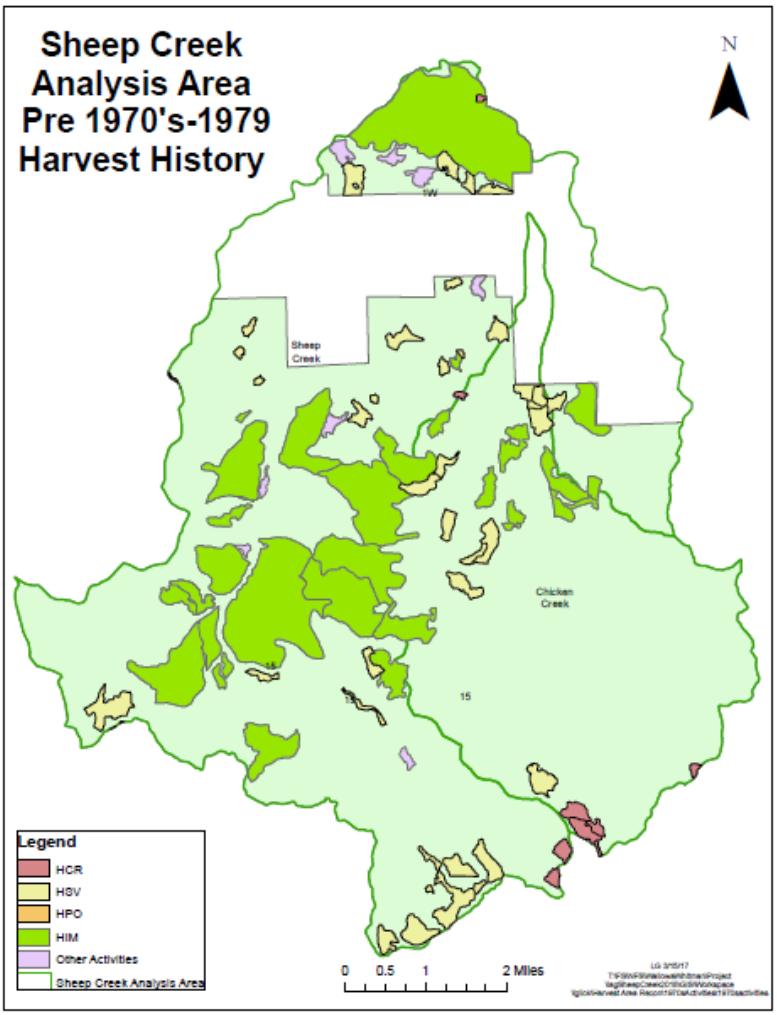

Figure 1- Forest Management performed by the forest service in the 1970's within the Sheep creek Project Area Boundary. HCR- Seed Tree Harvest (Regeneration harvest), HSV- salvage harvest, HPO- Gap opening harvest, HIM- improvement harvest.

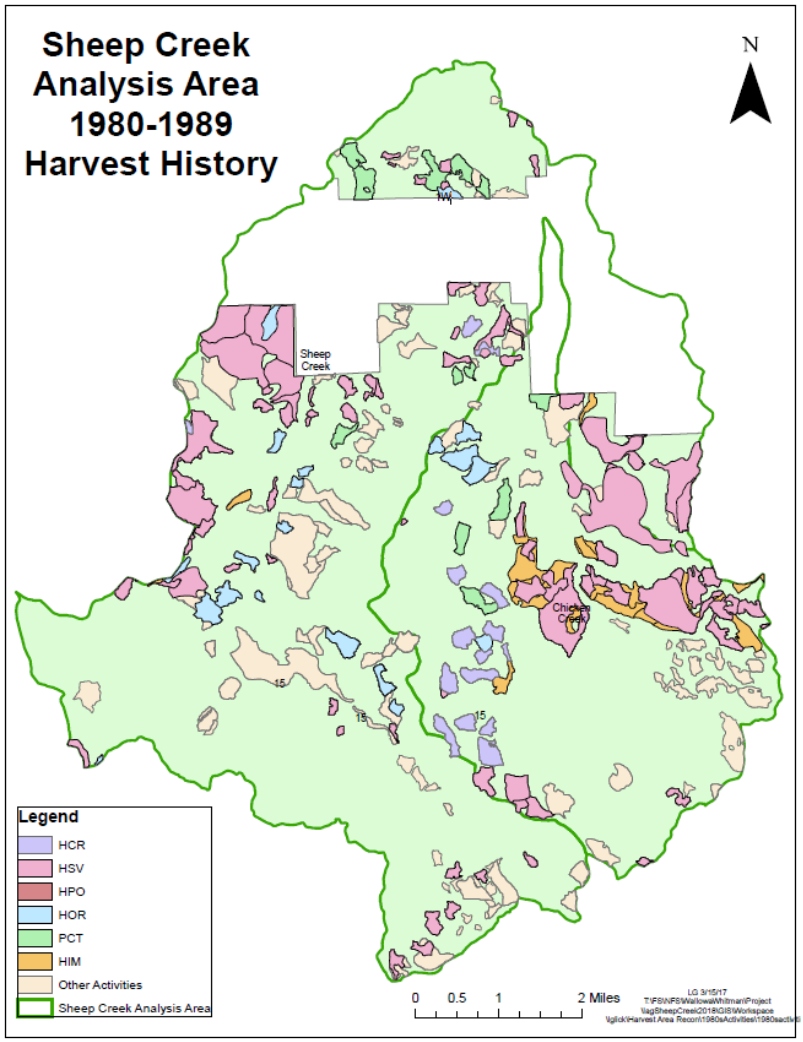

Figure 2-Forest Management performed by the forest service in the 1980's within the Sheep creek Project Area Boundary. HCR- seed Tree Harvest (Regeneration harvest), HSV- salvage harvest, HPO- gap opening harvest (Regeneration harvest), HOR-overstory removal, PCT- pre-commercial thin, HIM- improvement harvest

Management between the 1950s and the 1980s, an era when timber production still held primacy, the following land management strategies were commonly employed:

- Prompt suppression of wildfire.
- Sanitation and salvage of high-value trees at risk of insect or disease attack.
- Detection and chemical control of defoliating-insect outbreaks.
- Attempted eradication of introduced pests such as white pine blister rust

The goals of this era were clear: protect the forest from natural and human caused disturbances until the timber could be harvested (Powell 2019).

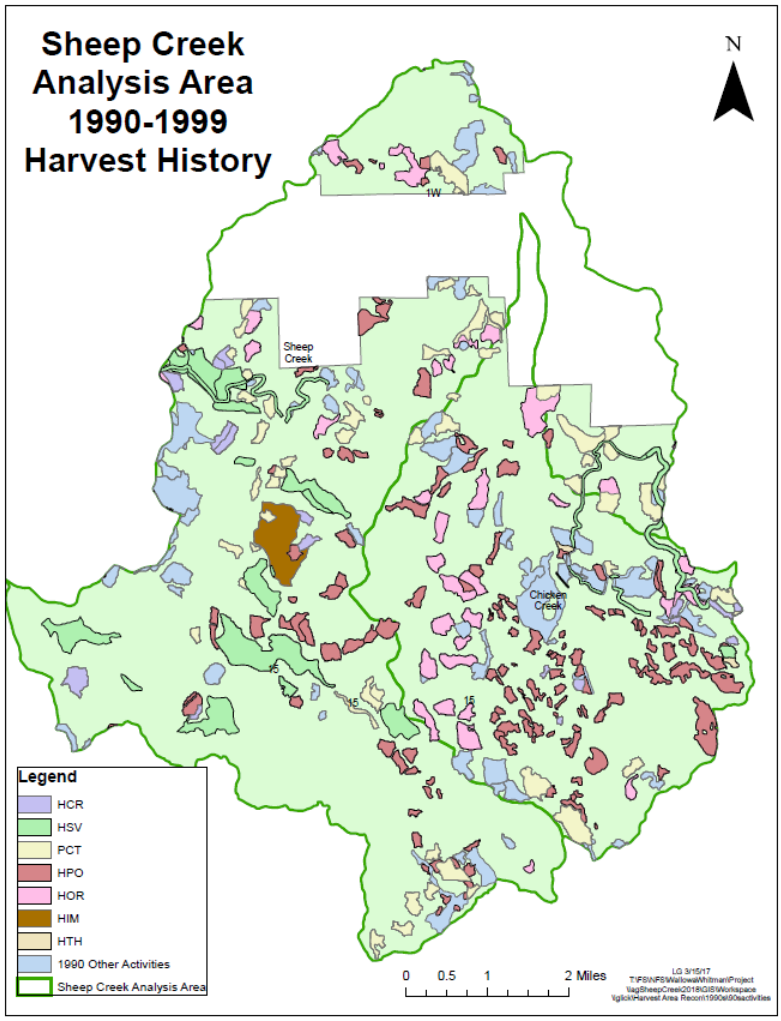

Figure 3-Figure 2-Forest Management performed by the forest service in the 1990's within the Sheep creek Project Area Boundary. HCR- Seed Tree Harvest (Regeneration harvest), HSV-salvage harvest, HPO- gap opening harvest, HOR-overstory removal, PCT- pre- commercial thin, HIM- improvement harvest

Beginning in the 1990s, the U.S. Forest Service adopted ecosystem management as a new paradigm emphasizing an ecological approach to natural resource management. Collectively, past management (fire exclusion, livestock grazing and past timber harvest practices) have created the current conditions that exist on the Sheep Creek landscape. Current structural conditions and species composition may contribute to increased probability of unnaturally severe wildfires, susceptibility to uncharacteristic insect outbreaks, and drought related mortality all within Sheep Creek. The changes have resulted in loss of large tree open habitat important for an array of wildlife species.

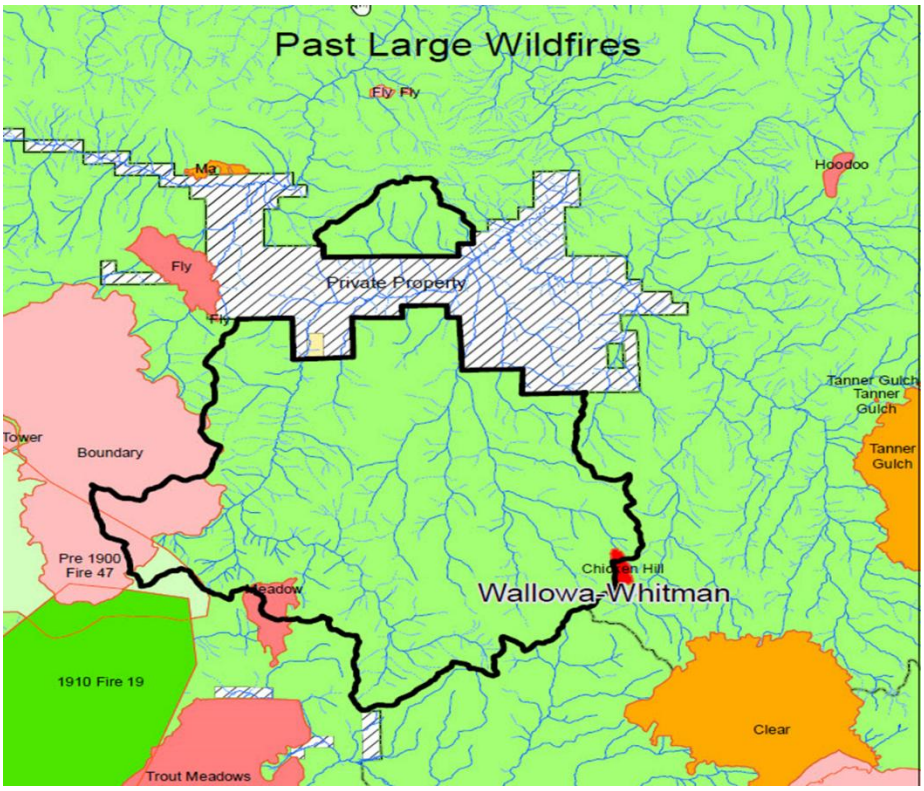

Figure 4- Past large wildfires around the Sheep Creek Project Area. There has not been any large fires within the majority of the project area for over 100 years. This is largely credited to the fire suppression effort from the Forest Service.

Potential Vegetation Groups

Potential vegetation (PV) is defined as the community of plants that would become established if all successional sequences were completed, without interference by humans. This implies that over the course of time and in the absence of future disturbances, similar types of plant communities will develop on similar sites (Powell, 2019). PV is an aggregation of plant association groups (PAGs) with similar environmental regimes and dominant plant species. They indicate the rate of which vegetation on a site changes (Powell 2019). Ecological and successional process are somewhat predictable using PVG proving themselves to be useful for estimating the impact of disturbance processes on differing ecological environments.

Table 1-PVG Groups within the Sheep Creek Project area

PVG Groups within the Project area *(Upland Forest Only)*		
PVG	Acres	% of project area
Cold Upland Forest	14,192	49
Dry Upland Forest	8,214	28
Moist Upland Forest	6,155	21
Other	614	2
Total	29,175	100

Notes: The sheep creek project area is dominated by Cold Upland Forest, nearly half of the entire project area covers 49% of the project area; Dry Upland Forest covers 28% and Moist Upland Forest covers 21 %.

Moist Upland Forest Group *(21% of the project area)*
These sites tend to occur at moderate elevations of the montane vegetation zone and at low elevations of the subalpine zone. They are the most productive PVG in the Blue Mountains, meaning they have the most available soil water throughout the growing season. Typically this is attributed to its soil properties, specifically the ash content in the soil mantle (leading to a higher water holding capcity), curtesy of Mt. Mazama roughly 7,700 years ago (USGS, 2020). Understories are primarily dominated by big huckleberry, and twinflower. Stand ages range from 35 to greater than 150 years old for trees greater than 9" DBH. Stand cover ranges from 30% to 73%. Species composition in these stands are a mix of species and size classes with subalpine fir and Engelmann spruce (*Picea engelmannii*),grand fir (*Abies grandis*) or Douglas-fir (*Pseudotsuga menziesii*)as the climax dominant species. Early seral species-western larch (*Larix occidentalis*) and ponderosa pine (*Pinus ponderosa)* existed historically in these stands at higher percentages then their current conditions. With the absence of fire in the project area, Moist Upland forest are experiencing convergent succession to fire intolerant species (primarily grand fir). Current stand densities are significantly greater in this upland forest group than others primarily attributed to soil water availability (Johnson 2017, Stine et al. 2014). This is decreasing individual tree vigor, causing intertree competition to occur and making them more susceptible to disturbances.

The degree of damage from insects- scolytus beetle (*Scolytus ventralis*) and Douglas- fir beetle *(dendroctonus pseudotsugae)* primarily is variable and depends upon factors such as species composition, tree size, tree vigor and occurrence of root/bole decays or mistletoe. Annosus *(heterobasidion annosum)* and Armillaria (*Armillaria luteoubalina)* root rots and Indian paint fungus *(Echinodontium tinctorium)* were all examined in parts of the moist PVG causing mortality in primarily grand fir. Mortality in many stands is typically less than 5% of the overstory. Mortality is primarily co-dominant or intermediate grand fir exhibiting live crown ratios less than 35% or Douglas-fir with a dwarf mistletoe rating of greater the 3. Tree mortally in known root disease pockets are higher (15-30%).

Dry Upland Forest Group *(28% of the project area)*
These sites occur low to moderate elevations of the montane vegetation zone. Less available soil moisture directly limits their productivity. Historically Dry-forest sites were dominated by ponderosa pine because it is well adapted to survive in a fire regime featuring low-severity fires occurring every 5 to 20 years (Powell 2014). This maintained a pattern of large, widely spaced fire tolerant trees with low flammability rates and contributed to ecosystem persistence. A surface fire regime creates open stand of fire-resistant species, where fire continues to thin stands and reduce competition for water. These forest have a long history of human use- past activities and fire exclusion. Suppressing fire has had an unintended consequence of allowing open stands of park-like ponderosa pine within Sheep Creek to be transformed into dense, thick forests of shade tolerant grand fir and Douglas-fir (figure 4).

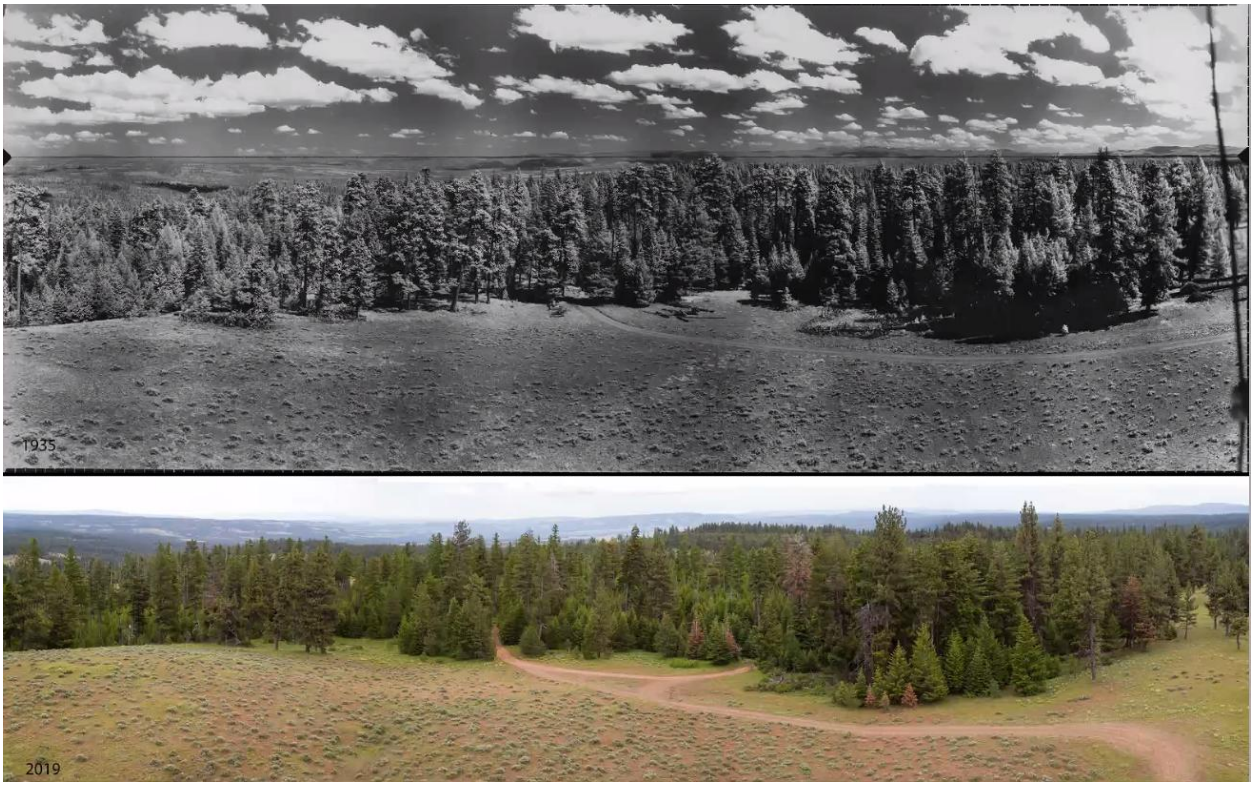

Figure 5- Shows a Dry PVG stand within the Starkey Experimental Forest, close proximity to the Sheep Creek project area in 1935 (top photo) to the current conditions (bottom photo) in 2019 (Marshall 2019). The unintended consequence of suppressing fire- a transformation, shifting much of the canopy leaf area from an overstory layer to one or more understory layers.

Species composition in these stands are a mix of species and size classes with predominantly Douglas-fir and ponderosa pine and grand fir. Understories are primarily dominated by elk sedge (*Carex garberi)*, Common snowberry *(Symphoricarpos albus)* and pinegrass (*Calamagrostis rubescens*). Stand age's range from 50 to greater than 150 years old for trees greater than 9" DBH. Stand cover ranges from 12% to 62%. Active insects and diseases observed in Dry Upland Forest consisted of primarily dwarf mistletoe *(Arceuthobium)* and scolytus beetle. Mortality in most stands is typically less than 11 % of the overstory. Mountain pine beetle *(Dendrocotonus ponderosae)* and Western Pine Beetle *(Dendroctonus brevicomis)* were also observed within stands causing greater mortality (up to 20%) in pockets within stands.

Cold Upland Forest Group *(49% of the project area)*
These sites are low to moderate in productivity and tend to occur at high elevations and have shorter growing seasons than Moist Upland forest or Warm Upland Forest (temperature-limited). Species composition in these stands are a mix of species and size classes with subalpine fir and Engelmann spruce as the climax dominant species. Early seral species- western larch and lodgepole pine (*Pinus contorta*) occur as early-seral species. Cold Upland forest typically experienced infrequent disturbances, such as stand-replacing fire on a cycle of 80-110 years. Many of these stands would remain in a dense, low vigor condition until a disturbance occurs.

Understories are primarily dominated by grouse huckleberry *(Vaccinium scoparium).* Mortality in many stands is often less than or equal to 10% of the overstory. Active insects and diseases were observed in these stands. Specifically, Mountain Pine Beatle and Balsam Woolly Adelgid (*Adelges piceae)* are causing the majority of mortality in stands. Stand ages for overstory greater than 9" (DBH) is 70 to greater than 120 years old. Success of regeneration is related to mortality and past disturbance. Stand cover ranges from 0%- 55%.

Insect/ Disease Activity

Insects: The degree of damage from insects is variable and depends upon factors such as species composition, tree size, tree vigor and occurrence of root/bole decays. Mountain Pine Beetle, larch casebearer moth (*Coleopholra laricella),* Western Pine Beetle, Fir Engraver, and Balsam Wooly Adgelid populations have shown a presence in the planning area within the last few years. Stands have pockets of beetle kill, recent attacks and breading populations. Fir engraver activity has been on the rise the last few years and is activity causing mortality in grand fir. This can be attributed to compounding drought.

Diseases: Tree diseases cause reduced growth rates, mortality, defect and decay. Incidence and severity of diseases in the Five Points project area are a combination of vegetation, successional stage, and disturbance (Scott, 1996). Major diseases in the area include root diseases (annosus and armillaria), Indian paint fungus, lodgepole cankers, heart rots and dwarf mistletoes. Infected trees can have a reduction in growth, topkill, premature mortality, susceptibility to other biotic agents and predisposition to crown fire (Schmitt, 1994). Overstocked stand conditions increase the risk of further loss of tree species.

HRV Analysis

Historic Range of Variation (HRV) is meant to reflect ecosystem properties free of major influence by Euro- American humans, providing insights into ecosystem resilience- what an ecosystem is capable of, how historical disturbance regimes functions and inherent variation in ecosystem conditions and processes (USDA Forest Service 1997). HRV are useful to guide management because forest were historically resilient to drought, insects, pathogens and severe wildfire.

Forest Structure

Table 2- Results of a HRV forest structure analysis for the Five Points Watershed (38,403 acres).

Table 1: Present and historical conditions of forest vegetation types in Sheep and Chicken Creek watersheds (HUC 12)			
PVG	**Existing Acres**	**% of PVG**	**Historical Range %**
Old Forest Multi Stratum (OFMS)			
moist upland	1191	19%	15-20%
dry upland	1119	14%	1-15%
cold upland	2422	17%	10-25%
Old Forest Single Stratum (OFSS)			

moist upland	0	0%	10-20%
dry upland	0	0%	40-65%
cold upland	1	<1%	5-20%
Understory Reinitiation (UR)			
moist upland	2755	45%	15-25%
dry upland	4085	50%	0-5%
cold upland	8119	57%	10-25%
Stem Exclusion (SE)			
moist upland	1,941	32%	20-30%
dry upland	2727	33%	10-20%
cold upland	3208	23%	15-30%
Stand Initiation (SI)			
moist upland	268	4%	20-30%
dry upland	283	3%	15-30%
cold upland	430	3%	20-45%

Notes: HRV results for Sheep Creek Project analysis area. The gray shading indicates structural stages that are within the HRV. Historical ranges were derived from Powell (2019). SI= stand initiation, SE= stand exclusion, UR= understory re-initiation, OFMS= old forest multi strata and OFSS= old forest single strata.

Fire suppression, fire exclusion and past vegetation management (timber harvest and grazing) activates have allowed shade tolerant species to invade dry forest sites because surface fire was prevented from fulfilling its role as a tree-thinning process. In moist and cold forest this has caused the loss of widely distributed remnant large and old early seral trees, patches of old forest, and of naturally recovering early successional communities. This has simplified species diversity at patch and larger scales and has transformed forest structure with growth (foliage biomass) shifting downward creating multiple lower layers.

The transformation of vertical structure impacts habitat for all pre-forest, early-, mid-, late-successional and old forest associates, and it is an intensification of disturbance, i.e. understory layers function as ladder fuels, increasing the probability of surface fire transforming into crown fires. The results of the forest structure HRV summarizes this transformation. Notably, old forest multi-strata (OFMS) is within the historic range of variation for all three PVG's, while there is a deficit in all PVG's old forest single-strata (OFMS). Understory re-initiation is also over represented and can be attributed to lack to fire suppression. Stem Exclusion is also over represented to on the landscape with the exception of cold PVG's; this can be attributed to the extensive regeneration or salvage harvest that occurred in the 70-80's as well as the stand replacement boundary fire and Meadow that were allowed to grown in without disturbance and now are experiencing intertree competition. Stand initiation is underrepresented across the landscape, as no regeneration harvest have occurred recently in the area nor other disturbance such as high severity wildfire or large areas of insect outbreaks.

Species Composition

Cover types are expressed as percentages of each PVG. Cover types may have a majority of one species (e.g., grand fir comprises more than 50% of stocking, coded as grand fir) or if less than

50% of a species is predominant, then a cover type is named for the species comprising a plurality of stocking.

Table 3- Vegetation Cover Type HRV Analysis for Moist Upland forest-current and desired species composition expressed as a percentage across the sheep creek landscape.

Vegetation Cover Type for Moist PVG	Range of variation for cover types (percentages)	Existing range of cover types (percentages)
Ponderosa Pine	5-15	< 1
Douglas-fir	15-30	4
Western Larch	10- 30	< 1
Lodgepole Pine	25-45	21
Grand Fir	15-30	73
Subalpine fir and spruce	1-10	2

*Notes: V*egetation Cover Type HRV Analysis for Moist PVG. The gray shading indicates Vegetation Cover Types within HRV, lodgepole pine and subalpine fir and spruce. Early seral species and mid seral species (ponderosa pine, western larch, and Douglas-fir) are below. Equally significant, is the over representation of the Grand Fir Cover Type. Grand fir encroachment can attributed to fire suppression. Regeneration harvest in the 70's and 80's within Moist PVG regenerated with lodgepole pine due to cold temperatures.

Table 4- Vegetation Cover Type HRV Analysis for Dry Upland forest- current and desired species composition expressed as a percentage across the sheep creek landscape.

Vegetation Cover Type for Dry PVG	Range of variation for cover types (percentages)	Existing range of cover types (percentages)
Ponderosa Pine	50-80	2
Douglas-fir	5-20	16
Western Larch	1-10	<1
Lodgepole Pine	0	11
Grand Fir	1-10	71
Subalpine fir and spruce	0	<1

Notes: The gray shading indicates Vegetation Cover Types within HRV, Douglas-fir and subalpine fir and spruce. Early seral species Cover Types (ponderosa pine, western larch) are below HRV and late-seral Grand Fir and lodgepole pine Cover Type are overrepresented. Grand fir encroachment can attributed to fire suppression. Regeneration harvest in the 70's and 80's within Dry PVG regenerated with lodgepole pine due to cold temperatures.

Table 5- Vegetation Cover Type HRV Analysis for Cold Upland forest current and desired species composition expressed as a percentage across the sheep creek landscape.

Vegetation Cover Type for Cold PVG	Range of variation for cover types (%)	Existing range of cover types (%)
Ponderosa Pine	0-5	<1
Douglas-fir	5-15	<1
Western Larch	5- 15	<1
Lodgepole Pine	25-45	46
Grand Fir	5-15	38
Subalpine fir and spruce	15-35	16

Notes: Ponderosa pine is not predicted to have much cover in cold forest due to tempertures. Subalpine fir/ spruce cover type is within HRV. Lodgpole pine and grand fir are over represented and Douglas-fir and western larch are underrepresented across the project area. Cold PVG stands that burnt in the Boundary fire and the Meadow fire regenerated back with lodgepole pine due to cold tempretures.

Results from the Cover Type HRV Analysis reflect the management history of Sheep Creek project area. Across Moist and Dry Upland Forest late seral (shade tolerant) and fire intolerant species (e.g Grand Fir) is over represented across the landscape. Fire suppression has transformed the structure shifting much of the canopy leaf area from an overstory layer to one or more understory layers. Dense conditions prevented early seral species to regenerate and get encroached on by shade tolerant species (Barrett, 1979). A surface fire regime typically expected on Dry Upland Forest and the drier spectrum of Moist Upland Forest (e.g., a moist forest stand , surrounded by Dry Upland forest) (Johnson 2017, Stine et al. 2014) creates an open stand of fire-resistant species giving them a competitive advantage against other species from occupying the site.

Fire suppression in Cold Upland Forest create conditions conducive for grand fir and sub-alpine fir regeneration over Douglas- fir or western larch. Cold temperatures gives lodgepole pine a competitive advantage over other species when occupying a site (e.g., a stand in the Stand Initiation forest structure stage) and is the largest cover type for Cold Upland forest. Predominantly Cold Upland Forest burnt in the Boundary and Meadow wildfires. These fires, along with regeneration harvest from the 70's and 80's, regenerated into Lodgepole Pine Cover Type.

Tree Density

Potential vegetation (PV) is an indicator of 'carrying capacity' for stand density (moist sites can support more vegetation than dry sites due to avilable soil moisture). PV controls the rate at which forests produce and accumulate density – how fast existing trees grow and how quickly new trees get established. Species composition has an important influence on stand density relationships because shade-tolerant trees can tolerate high density levels better than shade-intolerant tree species (Cochran et al. 1994).

Disturbance processes regulate stand density by periodically killing trees and maintaining stocking levels within a range of variation that differs for each combination of species and plant association (Cochran et al. 1994). Published stocking guidelines are used for evaluating stand density levels (Powell 1999). Stand density is a characterization of tree stocking for an area. It expresses the number of stems occupying a unit of land. Stand density provides an index of forest health concerns including and not limited to; competition, fire hazard, beetles and diseases (Cochran et al.1994, Powell 1999).

Tree density classes are defined as follows:

- Low Tree Density – are densities generally within the lower management zone for the species within each PVG.
- Medium Tree Density – are densities generally between the lower and upper management zones for the species within each PVG.
- High Tree Density – are densities generally near or above the upper management zones for the species within each PVG.

Table 6- Stand Density Class HRV Analysis within the Sheep Creek Project Area for Dry, Cold and Moist Upland forest as expressed as percentages by potential vegetation group.

Stand Density Class (Expressed as basal area, in ft^2/acre at 10" QMD)	Potential Vegetation Group Range of Variation (Percentage)			Current Conditions Range of Variation (Percentage)		
	Dry UF	Moist UF	Cold UF	Dry UF	Moist UF	Cold UF
Low (dry: <55; moist: <100; cold: <80)	40-85	20-40	15-35	30	22	27
Moderate (dry:55-85; moist:100-150; cold: 80-120)	15-30	25-60	20-40	34	44	25
High (dry:>85; moist: >150; cold: >120)	5-15	15-30	25-60	36	34	48

Notes: The Stand Density Class HRV analysis displays for Dry Upland Forest a surplus in area in Moderate and High Stand Density Classes, while lacking area in Low Stand Density Class. Moist Upland Forest is within HRV for low and moderate Stand Density Classes; however is over the HRV for High Stand Density Class. Cold Upland Forest is within HRV for all three stand density classes.

Desired Future Condition

The desired future condition is to have a mosaic of structural stages across the Sheep Creek planning area within the historical range of variation. The tree stocking and species composition would be consistent with historical disturbance patterns and managed at levels to prevent catastrophic insect and disease outbreaks. The stands would be of different ages and dispersed to provide a mixture of forage and thermal cover areas for big-game, and late-seral structures for old-growth dependent species. Silviculture treatments would create more heterogeneous stand structures that enhances resiliency to future disturbance. Large diameter (greater than 20 inches) down woody debris and standing snags would be more evident. Small diameter standing and down woody debris would be managed at levels to provide for soil productivity and decrease the risk of high-intensity fires.

Conclusion

The harvest, cultural, and post-sale activities would allow for an opportunity to maintain or increase the structural diversity in the analysis area and achieve the desired future condition. Silvicultural prescriptions result in maintaining or regenerating a mixture of tree species appropriate for each site, as well as, managing density levels at appropriate numbers.

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